CITY OF NEWARK
DELAWARE

CITY OF NEWARK
SOUTH WELL FIELD WATER TREATMENT PLANT UPGRADES
CONTRACT NO. 19-10

ADDENDUM 2
OCTOBER 30, 2019

1. Notice to Bidders

A. This Addendum is issued to all registered plan holders pursuant to the Conditions of the Contract. This Addendum serves to clarify, revise, and supersede information in the Project Manual, Drawings, and previously issued Addenda. Portions of the Addendum affecting the Contract Documents will be incorporated into the Contract by enumeration of the Addendum in the Owner/Contractor Agreement.

B. The Bidder shall acknowledge receipt of all issued Addenda with their submitted proposal.

C. Bid Documents must be received in the Purchasing Office prior to 2:00 p.m. prevailing time, November 12, 2019. Each bid so submitted shall constitute an irrevocable offer for a period of sixty (60) calendar days following the bid opening date.

2. Revisions

A. The attached Specification Section 27 20 00 – Data Communications is to be added to the project Specifications. See Appendix A.

B. Replace Specification Section 08 33 23 – Overhead Coiling Doors with the attached Specification Section 08 33 23 - Overhead Coiling Doors – Bid Addendum #2. See Appendix A.

C. Replace Specification Section 09 91 00 – Painting with the attached Specification Section 09 91 00 - Painting – Bid Addendum #2. See Appendix A.

D. Replace Specification Section 43 24 00 – Vertical Turbine Pumps with the attached Specification Section 43 24 00 – Vertical Turbine Pumps – Bid Addendum #2. See Appendix A.

QUESTIONS & ANSWERS

Q1: The overhead door specification lists motor operators and other electrical components for the overhead doors that do not appear on the drawings. Do the overhead doors need to be provided with motor operators or other electronic items?

A1: Overhead doors will need to be provided with motor operators. Revised plans will be included in Addendum #3.

Q2: Overhead door specification 08 33 23, 2.02 A 1 c says to provide perforated slats on 25% of the overhead door. The OH doors are also to be insulated. It may be counterproductive to provide perforated slats on an insulated door. Are we really to supply it this way?

A2: No. Provision for perforated slats has been removed from specification 08 33 23. See Appendix A.

Q3: Specification 09 91 00 1.01 B 2 says to paint the overhead doors. The overhead doors are to be galvanized material. Please confirm whether or not they will need to be field painted.

A3: Overhead doors will not be painted. Specification 09 91 00 has been revised. See Appendix A.

Q4: Are we only to paint items supplied under this contract or are there any existing surfaces that will need to be painted?

A4: Any locations where the existing coating has been removed to facilitate the installation of new equipment will need to be repainted.

Q5: There are two paint systems listed for interior ferrous metal, 099100 3.08 B and 099100 3.08 E. Please clarify which one should be used.

A5: The paint system specified under 09 91 00 3.08 B "Interior Ferrous Metal: Satin waterborne acrylic epoxy; (non-potable water finish)" is to be used on ferrous metals that will not be in contact with water. The paint system specified under 09 91 00 3.08 E must be used on any ferrous materials that are submerged in, subject to splash action from, or may otherwise be in contact with potable water per 09 91 00 2.03 A-1. Specification 09 91 00 has been revised. Paragraph 2.03 A-1 has been revised to further clarify this requirement. Note that the paint system specified under paragraph 3.08 E has also been revised. See Appendix A.

Q6: 43 22 13 1.01 D says "If VENDOR supplied equipment is delivered to an alternate location for storage, CONTRACTOR shall be responsible for transportation of equipment to the Project Site." Should we figure the cost of moving the equipment from a remote site to the jobsite in our bid?

A6: Yes. All equipment is to be delivered to the site. Should the contractor move the equipment to a new different location any cost associated with moving the equipment is the responsibility of the contractor.

Q7: Are any shop drawings available for the owner supplied air strippers so we can review prior to the bid?

A7: The City will provide shop drawings to the awarded Contractor once the submittal process is approved (estimated mid-December). For information purposes only, a single sheet Air Stripper Skid Detail and seven sheet promotional brochure both from Hydro Quip are being provided with this addendum. See Appendix B.

Q8: 43 24 00 1.05 J 1 – says that if the equipment is heavier than specified, the contractor is responsible for providing hoisting equipment. What is the specified weight for the pumps?

A8: The approximate weights for the pump assembly are as follows:

Motor: 1600 lbs
Discharge Head Assembly: 900 lbs
Column Assembly: 190 lbs
Bowl Assembly: 840 lbs
Total: 3530 lbs

Q9: 43 24 00 2.04 K 2 – says that the pump impeller should be bronze and 316 stainless steel. Please clarify which material should be provided for the pump impeller.

A9: Impellor shall be C876 bronze as specified with 316 stainless steel impellor lock collets. Specification 43 24 00 has been revised to clarify. See Appendix A.

Q10: 43 24 00 2.06 B – says to provide seal water at the pumps. The drawings do not show any seal water piping. Will any be required?

A10: Seal water and seal water piping is not required. Specification 43 24 00 has been revised to clarify. See Appendix A.

Q11: 43 24 00 2.10 D 9 – says that When pump witness performance testing is specified, provide roundtrip airfare, miscellaneous travel costs, and lodging for witness testing for two (2) people. Are we to include this cost in our bid?

A11: No. This requirement will be waived. Specification 43 24 00 has been revised to clarify. See Appendix A.

Q12: 43 24 00 3.02 D 5 d – contractor responsible for delivery and disposal of water used for testing. Can this requirement be waived?

A12: Yes, this requirement will be waived. Specification 43 24 00 has been revised. See Appendix A.

Q13: Can a specification be provided for the vent material that needs to be provided on top of the air strippers?

A13: Vent material shall be stainless steel ductwork as specified in Section 23 00 00 Para. 2.11.

Q14: I reached out to probably the biggest ready-mix concrete supplier in the Newark area and they only carry type I/II cement. That is the common answer when I ask the question up here is PA too. Can the spec

be adjusted or can you tell me of a supplier close to the job that has type II?

A14: Type I/II is acceptable for use where Type II is specified as it meets the requirements of Type II.

Q15: Will type I/II cement…which meets the specs for both type I and type II. Will this suffice?

A15: Same response as A14.

Q16: For the demolition work, will the Owner empty the contents of the lime silo and the two water storage tanks prior to the start of work?

A16: The Contractor is responsible to empty the contents of the lime silo. The Owner will empty the water storage tanks prior to the start of work.

Q17: On drawing D-02 the contractor has to remove and dispose of the lime. Please include the estimated quantity in the addendum and a material safety data sheet for the material.

A17: Approximately 5 tons of lime were added to the silo in August of 2017; however, the lime silo quantity indicator failed in early 2018 so the Owner cannot provide an estimated quantity. The SDS for the hydrated lime is attached. See Appendix C.

APPENDIX A

REVISED SPECIFICATIONS

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following types of electric-motor-operated overhead coiling doors:
   1. Fire-rated service doors – motor operated

B. Related Sections include the following:
   ~~1. Division 9 Section "Painting" for field-applied paint finish.~~
   2. Division 26 Sections for electrical service and connections.

1.03 DEFINITIONS

A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
   1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
   2. Impact Test for Flying Debris: Comply with ASTM E 1996, tested according to ASTM E 1886.
      a. Level of Protection: Basic Protection.
      b. Wind Zone One 110 mph, pressure test to 1/2 and 1-1/2 x design pressure (positive and negative).

B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 20 cycles per day.

1.05 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
   1. Summary of forces and loads on walls and jambs.
   2. Fire-Rated Doors: Include description of fire-release system including testing and resetting instructions.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available for units with factory-applied finishes.

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below.
   1. Curtain Slats: 12 inches long.
   2. Bottom Bar: 6 inches long.
   3. Guides: 6 inches long.
   4. Brackets: 6 inches square.
   5. Hood: 6 inches square.

E. Qualification Data: Submit Installer qualifications for approval by Field Representative.

F. Submit data for installed products in accordance with Operations and Maintenance Data, Manual for Operating Manuals in Division 1.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Test-Response Characteristics: Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alpine Overhead Doors, Inc.
2. Atlas Door; Div. of Clopay Building Products Company, Inc.
3. Cookson Company.
4. Cornell Iron Works Inc.
5. Dynamic Closures Corporation.
6. Mahon Door Corporation.
7. McKeon Rolling Steel Door Company, Inc.
8. Metro Door.
9. Overhead Door Corp.
10. Pacific Rolling Doors Co.
11. Raynor.
12. Southwestern Steel Rolling Door Co.
13. Wayne-Dalton Corp.
14. Windsor Door, a MAGNATRAX Corporation.

2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
      a. Minimum Base-Metal (Uncoated) Thickness: 22 gauge
      b. Flat profile slats.
      ~~c. Perforated slats, 25 percent of total door opening.~~
   2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces. Slats to have R-value of 16.0 (U-factor of 0.0625) as calculated using ASHRAE Handbook of Fundamentals.
   3. Inside Curtain Slat Face: To match material of outside metal curtain slat (22 gauge).

B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon.

Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Service Doors: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; galvanized to suit type of curtain slats.

D. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch- thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent over-travel of curtain, and a continuous bar for holding wind-locks.

2.03 HOODS AND ACCESSORIES

A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
1. Fabricate hoods for steel doors of minimum 0.028-inch- thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
2. Include automatic drop baffle to guard against passage of smoke or flame.
3. Shape: Round.

B. Smoke Seals: Provide UL-listed and -tested smoke-seal perimeter gaskets.

C. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors. At door head, use 1/8-inch-thick, replaceable, continuous sheet secured to inside of hood.
1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

D. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

E. Chain Lock Keeper: Suitable for padlock.

F. Power operated doors shall have safety interlock switch to disengage power supply when door is locked.

G. Provide automatic-closing device that is inoperative during normal door operations, with oscillating governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by the following:

1. Replaceable fusible links with temperature rise and melting point of 165 deg F. interconnected and mounted on both sides of door opening.
2. Building fire alarm and detection system and door-holder-release devices.

2.04 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.05 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

B. Comply with NFPA 70.

C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

F. Door-Operator Type: Provide wall, hood, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, enclosed gear-head-reduction drive, and chain and sprocket secondary drive.

G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.
1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
4. Provide open drip proof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.

H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
1. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
a. Provide pneumatically actuated automatic bottom bar.
1) Self-Monitoring Type: Four-wire configured device.

J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

K. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

2.06 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other

components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 STEEL AND GALVANIZED STEEL FINISHES

A. Factory Primer for Field Finish: Manufacturer's standard primer, compatible with field-applied finish according to coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
   1. Apply to ferrous surfaces except zinc-coated metal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.
   1. Install fire-rated doors to comply with NFPA 80.

3.02 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.03 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Submit written testing procedures for approval by Owner’s Representative.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Contracting Authority's maintenance personnel to adjust, operate, and maintain overhead coiling doors. Refer to applicable Division 1 Sections on Closeout Procedures and Demonstration and Training.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Work of this Section consists of providing all labor, material and equipment necessary for painting.

B. General the following items will require field painting:
1. Interior of concrete masonry unit walls
2. ~~Overhead coiling doors and hoods – paint all surfaces with exterior paint system~~
3. Ductile iron process piping – colors to match standard Water Authority colors.
4. Sealing and hardening all interior and exterior concrete walls, floors, and walks.

1.02 RELATED SECTIONS

A. Section 04 20 00, “Unit Masonry.”

~~B. Section 08 33 23, “Overhead Coiling Doors.”~~

1.03 DEFINITIONS

A. ”Paint” as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as a prime, intermediate or finish coats.

1.04 SUBMITTALS

A. Product Data: For each masonry paint system specified. Include block fillers and primers.
1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer’s catalog number and general classification.
2. Manufacturer’s Information: Provide manufacturer’s Product Data sheets, VOC levels, MSDS sheets and written application instructions including handling, storing, mixing requirements, specified thinners, thinner amounts, and application equipment recommendations for each coating material proposed for use.

B. Samples for Initial Selection: Contractor shall submit manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

C. Prior to beginning related work, Field Representative will furnish a color schedule and color chips for surfaces to be painted. Contractor shall submit samples of selected colors for review of color using appropriate paint type (s). Provide a listing of material and application for each coat of each finish sample.
   1. Furnish Field Representative "Drawdowns", 8-1/2 inch x 11 inch samples of each color used on project; identified with project name, date, color, and formula.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has a minimum of 7 years of successful in-service commercial experience with painting system applications similar in material and extent to that indicated for this Project.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Worksite in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45° F. Protect materials from freezing

1.07 JOBSITE CONDITIONS

A. Apply paints only when temperature of surfaces to be painted, surrounding air temperatures (50° F to 95° F), and humidity dew points meet paint manufacturer's printed instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The following paint manufacturers are approved:
   1. Pittsburgh Paint and Glass
   2. Sherwin Williams
   3. Tnemec Company, Inc.

B. All paint manufacturer's paint systems must meet or exceed paint requirements in accordance with Articles 3.08, 3.09 and 3.10 of this Section to be approved.

2.02 COLORS

A. Colors will be selected from approved paint manufacturer's color charts.

2.03 MATERIALS

A. General: Provide best commercial quality grade types of coatings as regularly manufactured by accepted paint manufacturers and meeting Paint Schedule requirements. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable. Provide undercoat paint products by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
   1. Any material coatings that will be: submerged in, subject to splash action from, or otherwise potentially in contact with potable water shall be certified to comply with National Sanitation Foundation/American National Standards Institute Standards (NSF/ANSI) 61. See article 3.08 E for potable water coating system for ferrous materials.

B. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coating system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Owner's Representative in writing of any anticipated problems using specified coating systems with substrates primed by others.

PART 3 - EXECUTION

3.01 ITEMS SHOP PAINTED UNDER OTHER SECTIONS OF THE SPECIFICATIONS

A. Acoustical metal decking used for ceilings in all spaces

B. Sheet metal flashing, fascia, gutters and downspouts

C. Fiber-cement siding, trim, soffit and fascia

D. Fiberglass doors and frames

E. Metal louvers and frames

3.02 ITEMS NOT TO BE PAINTED OR FINISHED

A. Fiberglass panels on interior walls

3.03 SURFACE PREPARATION

A. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

Cementitous Material: Prepare cementitous surfaces of concrete masonry units to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Allow new mortar and concrete to cure for 14 days.

Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

Ferrous Metals: Prepare ferrous metal surfaces according to SSPC- SP 6 Commercial Blast Cleaning. Touch-Up: Abrade damaged areas according to SSPC SP 11 Power Tool Cleaning to Bare Metal and spot-prime with Tnemec Series 90-97 Tneme-Zinc at recommended mil thickness. Follow with specified intermediate and topcoats.

Galvanized Surfaces: Chemically etch using a water-reducible phosphoric acid concentrate such as Great Lakes Laboratories Clean 'N Etch (1-800-356-3041) or approved equal.

3.04 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

3.05 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Apply additional coats when undercoats or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

C. Minimum Coating Thickness: Apply prime coat of material which is required to be painted or finished, and which has not been prime-coated by others.

D. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

E. Smooth Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface or uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

G. Concrete Masonry Unit Finishes: When concrete masonry finish requires a block filler, Field Representative shall inspect walls after block filler has been applied to ensure adequate filling. Final coat(s) shall not be applied until block filler coating has been approved.

H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint work that is not in compliance with specified requirements equal to the approved sample.

3.06 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.07 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as directed by the Field Representative.

B. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.08 INTERIOR PAINT SCHEDULE

A. Interior Concrete Masonry Units (CMU): Waterborne Acrylic Epoxy finish.
   2. Two (2) coats of cementitious blockfill. Total DFT 8.0 to 12 mils total– 80-100 sq. ft/gallon each coat (Tnemec, Envirofill, Series 130)
   3. Two (2) coats of satin waterborne acrylic epoxy. DFT – 8 to 12 mils total (Tnemec, H.B. Tnemec-Tufcoat, Series 113)

B. Interior Ferrous Metal: Satin waterborne acrylic epoxy; (non-potable water finish)
   1. One (1) coat of polyamidoamine epoxy. DFT – 4.0 mils (Tnemec, Hi-Build Epoxoline II, Series N69)
   2. One (1) coat of satin waterborne acrylic epoxy. DFT – 5.0 mils (Tnemec, H.B. Tnemec-Tufcoat, Series 113)
   3. First coat not required if factory primed (Check adhesion with a test patch) spot prime abraded areas only with polyamidoamine epoxy primer.

C. Interior Galvanized Metal: Satin waterborne acrylic epoxy;
   1. Thoroughly remove all foreign contamination by wiping with solvent recommended by paint manufacturer.
   2. One (1) coat of polyamidoamine epoxy. DFT – 4.0 mils (Tnemec, Hi-Build Epoxoline II, Series N69)
   3. One (1) coat of satin waterborne acrylic epoxy. DFT – 5.0 mils (Tnemec, H.B. Tnemec-Tufcoat, Series 113)

D. Concrete walls and floors: Sealer/Hardener
   1. Remove all foreign material and thoroughly wash and dry concrete.
   2. One (1) coat of Ashford Formula or approved equal according to manufacturer's requirements.

E. Interior and Exterior Ferrous Metal: Polyamide Epoxy; (potable water finish, certified by NSF International in accordance with ANSI/NSF Std. 61)
   1. Two (2) coats of polyamide epoxy, DFT – 4.0 mils each (Tnemec Pota-Pox, Series 20). First coat shall be different color than finish coat.

3.09 EXTERIOR PAINT SCHEDULE

A. Exterior Galvanized Metal: Semi-gloss Thermoset Solution Fluoropolymer; .
   1. One (1) coat of polyamidoamine epoxy. DFT – 3.0 mils (Tnemec, Hi-Build Epoxoline II, Series N69)
   2. One (1) coat of aliphatic acrylic polyurethane. DFT – 3.0 mils DFT per coat (Tnemec, Endura-Shield II, Series 1075)
   3. One (1) coat of thermoset solution fluoropolymer. DFT- 3.0 mils (Tnemec, Fluoronar, Series 1071)

B. Concrete walks and walls: Sealer/Hardener
   1. Remove all foreign material and thoroughly wash and dry concrete.
   2. One (1) coat of Ashford Formula or approved equal according to manufacturer's requirements.

3.10 PERFORMANCE CRITERIA

A. Tnemec Series 113 H.B. Tneme-Tufcoat

ADHESION ASTM D4541	Steel Primed: 1,000 psi Concrete Direct: 380 psi
SALT SPRAY ASTM B117	N/A
ABRASION ASTM D4060	160 mg. loss 1,000 cycles CS 17 Wheel 1,000 gr. Load
EXTERIOR EXPOSURE	3 years less than 5 MacAdam units color change
FRESH WATER	N/A
HARDNESS ASTM 3363	N/A
HUMIDITY ASTM D2247	N/A
SURFACE BURNING CHARACTERISTICS	Class A
TEMPERATURE RESISTANCE	170°F Continuous 250°F Intermittent
STEAM RESISTANCE	10 hrs. no gloss change less than 2 MacAdam units color change
SCRUBBABILITY ASTM D4213	1,000 cycles less than .8 mils removed, less than 2 units colot change. Erosion rate less than 25 microliters per 1,000 cycles

B. Tnemec Series 130 Envirofill

ADHESION ASTM D3359	No less than 5B
EXTERIOR EXPOSURE	3 years Light Industrial Topcoated. No blistering, cracking or delamination of film.
HUMIDITY ASTM D4585	1 ct. of Series 130/Topcoated W/Tneme-Tufcoat. No blistering, cracking or visible loss of film integrity after 1,500 hrs of exposure.
STEAM PRESSURE TEST PRESSURE POT AT 250°F AND 15 TO 17 PSI.	1 ct. of Series 130 Envirofil l/2 cts. of Series 84 Ceramlon. No blistering or cracking of coating after 4 hours continuous exposure.
WIND-DRIVEN RAIN **TT-C-555B 4.4.7.3**	24 hours no visible dampness on the backside after 24 hours. No blistering, cracking or visible damage to the substrate or coating
FREEZE-THAW **ASTM D2246**	30 cycles No blistering, cracking or loss of adhesion.

C. Tnemec Series N69 Hi-Build Epoxoline II

ADHESION ASTM D4541	No less than 1,900 psi pull, average of three tests.
SALT SPRAY **ASTM B117**	Two coats Series N69 Hi-Build Epoxoline II. * No blistering , cracking, rusting or delamination of film. No more than 1% rusting on plane and 1/64" rust creepage at scribe after 10,000 hours
ABRASION ASTM D4060 CS17 WHEEL, 1,000 GRAM LOAD, 1,000 CYCLES	No more than 140 mg loss after 1,000 cycles
ARTICLE 2 FRESH WATER	N/A
HARDNESS ASTM 3363	
HUMIDITY ASTM D4585	Two coats Series N69 Hi-Build Epoxoline II. * No blistering , cracking, checking, rusting or delamination of film after 10,000 hours exposure.
MOISTURE VAPOR TRANSMISSION ASTM D 1653	No more than 9.9 g/m sq. 24 hours water vapor transmission and no more than 0.31 grains/ft sq./hr in Hg. water vapor permeability.
TEMPERATURE RESISTANCE	250F Continuous

D. Tnemec Series 1075 Endura-Shield II

ABRASION ASTM D 4060	No more than 115 mg loss after 1,000 cycles
ADHESION ASTM D4541	Tnemec Series 69/Tnemec Series 1075. No less than 1,833 psi, average of three tests.
SALT SPRAY **ASTM B117**	Series N69/ Series 1075* No blistering , cracking, rusting or delamination of film. No rust creepage at scribe after 1,500 hours
PROHESION ASTM G 85	No blistering, cracking or delamination of film. No more than 1/64" rust creapage at scribe after 15,000 exposure

HUMIDITY ASTM D4585	Series N69/Series 1075. * No blistering , cracking, rusting or delamination of film after 1,500 hours exposure.
QUV EXPOSURE ASTM D 4587	No less than 97% gloss retention after 2,000 hours exposure.

E. Tnemec Series 1071 Fluoronar

ABRASION ASTM D 4060	No more than 103 mg loss after 1,000 cycles.
ADHESION ASTM D4541	No less than 916 psi, average of three tests
SALT SPRAY **ASTM B117**	Series 90-97/ Series 1071* No blistering , cracking, rusting or delamination of film. No more than 1/16" rust creepage at scribe after 10,000 hours.
FLEXIBILITY ASTM D 522	No less than 34% elongation average of three tests.
HUMIDITY ASTM D4585	Series 90-97/Series N69/Series 1071. * No blistering , cracking, rusting or delamination of film after 2,500 hours exposure.
IMPACT ASTM D 2794	No visible cracking or delamination of film after 148 inch-pounds or less direct impact and 84 inch-pounds indirect impact.
QUV EXPOSURE ASTM G 53	No blistering, cracking or chalking. Less than 5% gloss loss and 0.8 DED FMCII (MacAdam units) color change after 9,500 hours exposure.

END OF SECTION

SECTION 27 20 00

DATA COMMUNICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide, install, test and put in operation an Ethernet based data network as specified. The network shall include, but not limited to, fiber optic cabling system, network boxes, fiber patch panel, fiber connections, network switches, and miscellaneous equipment to provide a complete functional data network system.

1.02 REFERENCES:

A. National Fire Protection Association (NFPA):

1. NFPA-70: National Electrical Code (NEC).

B. Underwriters Laboratories, Inc. (UL):

1. U.L. 1581 VW-1: Vertical Tray Cable Flame Test

2. U.L. 1666: Riser Cable

3. U.L. 508: Standards for Safety, Industrial Control Equipment

C. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE Standard 383: Flame Retardancy.

2. IEEE 802 (Series): Standards for Local and metropolitan Area Networks.

3. IEEE 1588: Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems.

D. American National Standards Institute (ANSI):

1. ANSI/ISA-99: Security for industrial Automation and Control Systems.

E. NETA: The International Testing Association Acceptance Testing Specification.

F. TIA/EIA-568-B/C (Series): Commercial Building Telecommunications Cabling Standards.

G. TIA/EIA-569 (Series): Commercial Building Standard for Telecommunications Pathways and Spaces.

H. TIA/EIA-526 (Series): Standard Test Procedures for Fiber Optic Systems.

I. TIA/EIA-604 (Series): Fiber Optic Connector Intermateability Standard (FOCIS).

J. Internet Engineering Task Force (IETF) RFC documents (various).

1.04 SUBMITTALS:

A. Submit the following shop drawings in accordance with Section 01 33 00:

1. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.

a. Failure to include a copy of the marked-up specification sections will result in rejection of the entire submittal with no further review and consideration.

2. Installer Qualifications – Include resumes of staff and previous project experience with references. Proposed Products List.

3. Outline drawings of termination cabinets showing dimensions, cables, jumpers and associated hardware for termination.

4. For each component and material submit shop drawing which shall include:

a. Manufacturer.

b. Model number.

c. General data and description.

d. Engineering specifications and data sheets.

e. Catalog cuts.

f. For information purposes only, submit manufacturer's printed installation instructions.

B. Submit a drawing showing the routing for the fiber optic network. Include the following information:

1. Routing, length, and attenuation based on TIA-568-A.

2. Cable and conduit identification.

3. Locations of manholes, pull boxes and patch panels.

C. Provide network wiring tables spreadsheet in Excel format listing all structured cabling components and cabling source and destinations connections for each fiber optic cable transmit and receive pair for backbone, also include each fiber optic patch cord, each CAT6 patch cord, each patch panel port and each network equipment switch port.

D. Test Documentation:

1. Document results of tests (shop test, field test, acceptance test) and submit copies of documents to Engineers as tests are completed.

E. As-Built:

1. Provide as-built drawings at the completion of the Contract. The marked up drawing set will accurately depict the as-built status of the communication system including termination locations, cable routing, and administration labeling for the cable system.

2. Provide End-to-End insertion loss data for all fiber and individual Splice Loss and Connector Insertion Loss data.

3. Submit Component Data.

a. Manufacturer and model number

b. General data description

c. Engineering specifications and data sheet

d. Scaled drawings and mounting arrangements

e. Power and grounding requirements

f. Electrical and network interfaces (copper and optical)

1.05 QUALITY ASSURANCE:

A. Fiber optic cables and related equipment shall be the products of approved manufacturers. Fabrication of the fiber optic cables and related equipment shall utilize the most advanced commercial materials and manufacturing processes. Manufacturer shall be ISO 9001 and TL-9000 certified.

B. Fiber optic cable installation shall be performed by experienced fiber optic cable installers who shall have been regularly engaged in the installation of fiber optic cables for the last five (5) years at the minimum.

C. Fiber optic cable splicing and terminations shall be performed by experienced cable splicers who shall have been regularly engaged in splicing and termination of fiber optic cables for the last five (5) years at the minimum.

D. All cables and terminations shall be identified at all locations. All cables shall terminate in an alphanumeric sequence at termination locations.

E. All Fiber Optic cable terminations shall comply with and be tested to ANSI/TIA/EIA 568-B standards for single-mode and multi-mode Fiber installation for Fiber Optics.

F. All optical fiber components (optical fiber, cable, connectors, patch panels, hardware and patch cords) shall be manufactured by a single company, unless otherwise noted, in order to ensure consistency and compatibility.

1.06 EQUIPMENT IDENTIFICATION:

A. Each fiber shall be labeled at each termination point and all splice location including spares. Conductor or circuit identification shall be applied at specified points with circuit numbers or other identification stamped on terminal boards when provided, or on the cable itself in such a manner that the identification is visible around the cable's circumference.

B. Each fiber shall be identified in junction boxes, pull boxes, manholes, handholes, terminal boxes, and cabinets. Where no termination is made, use a plastic-coated, self-adhesive, wire marker. Where termination is made, use a plastic, pre-printed sleeve wire marker. Paper self-adhesive wire markers are not acceptable.

1.07 SHOP TESTS:

A. Fiber optic cables and equipment shall be shop tested at the manufacturer's plant in accordance with the manufacturer's standard testing procedures. Shop tests shall be performed prior to shipment.

B. Submit manufacturer's shop test reports.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Fiber Optic Cabling System.

1. Corning Cable Systems.

2. Chromatic Technologies, Inc.

3. Belden (Cooper Industries).

4. OFS Fiber.

5. Or acceptable equivalent product.

B. Network Switches and routers:

1. Cisco or equal.

2.02 FIBER OPTIC CABLE:

A. General:

1. Provide multi-mode, buffered, optical glass fiber cores based transmission systems. Maximum attenuation losses shall be 3.4 dB/km or less at a wavelength of 850 nm and 1.0 dB/km or less at a wavelength of 1300 nm. Minimum bandwidth shall be 200 MHZ-km at 850 nm and 500 MHZ-km at 1300 nm. Fiber core size shall be 62.5 micron unless otherwise required. All plastic fiber core construction shall not be acceptable.

2. The Fiber Optic Cables provided shall be fully water blocked with a jacket to resist 3 feet deep water.

B. Fiber Optic Non-Breakout Cable:

1. Heavy duty, tight buffer construction with additional strength members, and an oil, water, and chemical resistant, UV stabilized, flame retardant, PVC outer jacket, UL listed OFNR. Fiber cladding shall be 125 micron and fiber buffer shall be 900 micron.

2. Cable specifications:

a. Fiber Count: 12

b. Suitable for indoor/outdoor, direct buried, cable tray and duct installation.

c. Minimum Crush Resistance: 80 lbs/inch [3.2 kg/cm]

d. Operating Temperature: -10 to +50 degrees C [14 to 122 degrees F]

C. Code Compliance:

1. The cable must meet the requirements of the National Electrical Code® (NEC)® Section 770.

2. Cables shall conform to the applicable performance requirements of the Insulated Cable Engineers Association, Inc. (ICEA) *Standard for Indoor-Outdoor Optical Fiber Cable* (ICEA S-104-696).

D. Packing and Shipping:

1. The completed cable shall be packaged for shipment on non-returnable wooden reels. Required cable lengths shall be stated in the purchase order.

2. Top and bottom ends of the cable shall be available for testing.

3. Both ends of the cable shall be sealed to prevent the ingress of moisture.

4. Each reel shall have a weather resistant reel tag attached identifying the reel and cable.

5. Each cable shall be accompanied by a cable data sheet.

E. Shop Tests:

1. All optical fibers in cables lengths of 1,000 m or greater shall be 100 percent attenuation tested. The attenuation shall be measured at 850 nm and 1300 nm for multimode fibers. The attenuation shall be measured at 1310 nm and 1550 nm for single-mode fibers. The manufacturer shall store these values for a minimum of five years. These values shall be available upon request.

2.03 TERMINAL CONNECTORS:

A. Manufacturers: Ortronics, Corning Cable Systems, 3M Telecom Systems Group, or approved equal.

B. Connectors: ST type (AFL Fuse Connect ST). The connector shall be field installable, requiring no epoxy or polishing. Connector specifications shall be as follows:

1. Insertion loss (typical): 0.3 dB (maximum).

2. Operating Temperature: -40 to +60 degrees C [-40 to +140 degrees F]

2.04 CAT6 CABLE:

A. Provide twisted-pair cable, connectors and appurtenances that make up the copper CAT6 cable segments.

A. Cable segments shall meet the requirements of the TIA/EIA-568-B specification for Category Six (CAT6), Unshielded Twisted Pair (UTP) cable.

B. Cable Segments shall meet or exceed the following minimum requirements:

1. The cable shall be tested up to 200 MHz with a guaranteed performance that meets or exceeds the ANSI/TIA/EIA-568B/ISO/IEC 11801 horizontal cable requirements for PS-NEXT, attenuation, structural return loss, and attenuation-to-crosstalk ratio (ACR).

2. The cable shall be constructed from 0.54mm (24AWG), bare copper wire insulated, UTP, UL/NEC CMR rated, with a white, gray, blue or yellow plenum-rated PVC jacket. Two insulated conductors twisted together to form a pair and four pairs laid up to form the basic unit.

3. The cable shall be jacketed in flame-retardant PVC. Cable run in conduit shall meet or exceed FT4 rating. Cable not run in conduit shall meet or exceed FT6 rating.

4. Cable jacketing shall be lead-free. Cable shall be supplied on wooden reels or in reel-in-box. Cable shall be UL listed under file number E138034. CAT6.

2.05 CONNECTING CORDS, DEVICES AND ADAPTERS:

A. Optical patch cords shall be provided to patch the network switches to the patch panel. Connectors to be compatible with the network equipment.

2.06 ENCLOSURE WIRING:

A. All fibers shall be terminated, tested, installed and ready for use.

B. All enclosure wiring shall run through a cable manager.

C. Cable managers shall not be filled to more than 50 per cent of their volume upon initial installation.

D. All wires and cables, including spares, shall be identified at each end and at any connection. Use durable non-fading sleeve type wire markers to identify all network cables.

2.07 OPTICAL HARDWARE:

A. Manufacturers: Ortronics, Corning Cable Systems, 3M Telecom Systems, Group, or approved equal.

B. Equipment Rack:

1. The equipment rack shall conform to Electronics Industry Association (EIA) EIA-310 standards.

2. The equipment rack shall be manufactured from aluminum for lighter weight and ease of assembly during installation. The rack shall be black in color. Installation fasteners shall be included and shall be black in color.

3. Blank rack panels shall be available to fill unused rack space.

C. Connector Panels: Rack and wall mountable connector housings shall accept an interchangeable connector panel. A connector panel is defined as a modular removable plate containing optical fiber connector adapters or copper jacks. The connector panel shall have the following characteristics:

1. The connector panel shall utilize a single mounting footprint and shall be available with three, four, six, eight or twelve connector adapters in each panel. Copper jack panels shall accept up to four copper jacks. The connector panel shall be interchangeable between the rack and wall mountable hardware being proposed. The panel shall be attached with two push-pull latches to allow quick installation and removal.

D. Connector Modules: Rack mountable connector housings shall accept an interchangeable connector module. A connector module is defined as a modular removable case containing optical fiber connector adapters and provisions for strain-relief, slack storage, and the furcation of fiber optic cables.

E. Rack Mountable Connector Housings: Rack mountable connector housings shall be available for cross-connecting or inter-connecting purposes. The units shall provide for direct connectorization and pigtail splicing.

2.08 NETWORK EQUIPMENT ENCLOSURES:

A. Network equipment enclosures shall be used to house networking devices and patch panels.

B. Network equipment enclosures shall provide a wire duct for communication cables and fiber optic cables between the communication devices in control panel and communication raceways.

2.09 MANAGED ETHERNET SWITCHES:

A. The Ethernet switches shall be Cisco STRATIX 5700 with REP (Resilient Ethernet Protocol) series managed switches or equal.

B. Ratings:

1. The managed Ethernet switch shall be rated for:

a. -40 to 60 °C (-40 to 140 °F) operating temperature.

b. 5 to 95% noncondensing ambient relative humidity.

C. The Switch shall be UL Listed Industrial Control Equipment.

D. Construction:

1. The switch shall have:

a. Power Source: Single 120 VAC power source.

b. Ports: 10 ports (minimum) fixed configuration plus 2-gigabit copper RJ-45 ports.

c. PoE: 4 ports capable of Power over Ethernet (PoE), providing electrical power along with data on a single Ethernet cable to end devices.

d. Alarms: 6-pin alarm connector to provide an interface for 1 output alarm relay circuit and 2 input alarm relay circuits.

e. LEDs: 4 LED indicators displaying hardware and network link status.

f. Memory: 256 MB DRAM and 64 MB onboard flash memory.

g. SD Card: The switch shall have a slot for a Secure Digital (SD) card.

E. Functions:

1. The switch shall support Ethernet/IP protocol.

2. The switch shall be able to trigger alarms for faults (power supply, temperature, FCS bit error, loss of signal, port operation) and make notifications.

3. The switch shall be able to prioritize automation control traffic (time sync, motion control, safety I/O, standard I/O) using Quality of Service (QoS).

4. The switch shall include the following security features:

a. Username and password for remote and local (console) access.

b. Password for the read-write access to parameters from a control system.

c. Authentication protocol support: AAA, RADIUS.

d. Secure management protocols: SSHv2, SNMPv3, HTTPS.

e. Port-based authentication and VLAN assignment: IEEE 802.1x

5. The switch shall be able to encrypt administrator traffic.

F. Configuration:

1. The managed Ethernet switch shall have the following configuration options:

a. Express Setup procedure with a web browser that configures basic parameters for typical industrial applications.

b. Device Manager Web interface configuration.

c. Built-in global or interface-level macros (command templates) that allow easy setup of the switch in a configuration optimized for the specific application.

d. Logix Designer application in Studio 5000 - a protocol interface using the same software and tools as those for a control system.

G. Diagnostics and Monitoring:

1. The managed Ethernet switch shall support diagnostic and monitoring via:

a. Web interface (HTTP).

b. System message logging (syslog).

c. SNMP protocol version 2c and 3.

d. Port mirroring.

e. Ethernet/IP application protocol interface to a control system

PART 3 - EXECUTION

3.01 GENERAL:

A. Provide all material, equipment, and labor to install the fiber optic cables and network devices as indicated and as specified.

B. Installation shall be in accordance with the National Electrical Code and all local codes.

3.02 INSTALLATION:

A. Install cables in accordance with manufacturer's printed instructions.

B. Install cable directly from shipping reels. Ensure that cable is not:

1. Dented, nicked, or kinked.

2. Subjected to pull stress greater, or bend radius less, than manufacturer's specification.

3. Subjected to treatment which may damage fiber strands during installation.

C. Conduit: Install fiber optic cable directly in conduit.

D. Splices: None.

E. Identification: Identify each cable on both ends and in all manholes and pull points it goes through.

F. Sequencing: Provide cables in accordance with sequencing requirements.

G. Handholes:

1. Provide supports for cables at maximum 300-millimeter centers along sides of manholes.

2. Provide a minimum 4-foot coil of spare fiber in each manhole throughout the cable length.

H. Install fiber optic cables in underground ducts. Rod and swab out ducts prior to installing cables.

I. Install fiber optic cables in the conduit systems provided inside buildings and structures.

3.03 CABLE TERMINATIONS:

A. Terminate cables in accordance with TIA-568.

B. Fan out fibers to allow flexibility and ease of installations for future expansion at connection points. Provide a metal or high density plastic fan-out collar to relieve the stress on the individual fibers. To protect the individual fibers, provide sleeves from the fan-out collar to the terminal point. Terminate all fibers in each cable with a suitable connector as specified.

C. Provide a minimum of 20 feet [6 meters] of neatly coiled, slack fiber optic cable at each terminal cabinet or backboard for flexibility.

3.04 PHYSICAL CHECKOUT:

A. General Procedures:

1. Conduct physical checkout of the fiber optic data highway network.

2. Physical checkout shall be performed prior to functional testing.

B. Check Procedures:

1. Verify that fiber optic cables reels have been off-loaded from truck carefully and not damaged.

2. Verify that the optical fibers of the cable assembly are the type and quantity as specified.

3. Verify that cable construction is the type specified.

4. Verify that fiber optic patch panels have been installed plumb and level at locations indicated.

5. Verify that fiber optic splice closures have been installed at locations indicated.

6. Verify that optical fiber connections or terminations within patch panels and splice closures are in accordance with cable manufacturer's printed recommendations.

3.05 FIELD TESTING:

A. Conduct the following field tests after cable installation:

1. Visually, inspect terminal connectors for out-of-round condition and surface defects such as micro-chips and cracks using a 100X (minimum) inspection microscope.

B. Cable Testing:

1. Provide equipment, instrumentation, and supplies necessary to perform testing. Engineer and Owner shall have the option to witness and participate actively in on-site tests.

    a. Notify Engineer and Owner at least 10 days prior to testing.

2. Perform all tests and inspections as required by NETA.

3. Post-Installation Testing: Demonstrate that all fibers in each cable meet requirements of TIA-568 as modified here:

    a. Maximum attenuation as specified.

    b. Measure attenuation in both directions, not in one direction only.

4. Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturer's recommendations.

    a. Each strand shall be tested on all outside plant cables and/or where splices exist.

5. Replace all cables or mated connector pairs that do not meet attenuation standards and redo tests until cable meets requirements and at no additional cost to the Owner.

6. Submit testing results for review and approval.

3.06 CONTRACT CLOSEOUT:

A. Provide in accordance with Section 01 77 00.

END OF SECTION

SECTION 43 24 00

VERTICAL TURBINE PUMPS AND APPURTENANCES (LEAD FREE)

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide and test vertical turbine pumps, motors, suction cans, variable frequency motor controllers and appurtenances as indicated and in compliance with Contract Documents.

B. Pumps or all pump wetted parts must meet NSF 61.

C. The contractor shall furnish an industrial product lubricated lineshaft vertical turbine pump, with above ground discharge and furnished with suitable driver and accessories to meet the requirements herein or as shown on the drawings. The pump shall be designed and furnished to conform to the Hydraulic Institute and AWWA specifications for Lineshaft Turbine Pumps and shall comply with all local and state sanitary and safety regulations.

1.02 REFERENCES:

A. ASTM International (ASTM):

1. A36/A36M: Standard Specification for Carbon Structural Steel.

2. A48/A48M: Standard Specification for Gray Iron Castings.

3. A53/A53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

4. A120: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless for Ordinary Uses.

5. A283: Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

6. A395: Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures

7. A536: Standard Specification for Ductile Iron Castings.

8. A582: Standard Specification for Free-Machining Stainless Steel Bars

9. A743/A743M: Standard Specification for Castings, Iron-Chromium, Iron-Chromium Nickel, Corrosion Resistant, for General Application.

10. B148: Standard Specification for Aluminum-Bronze Sand Castings

11. D2240: Standard Test Method for Rubber Property – Durometer Hardness.

B. American National Standards Institute (ANSI):

1. S1.11: Standard Octave-Band and Fractional-Octave-Band and Digital Filters.

C. American Society of Mechanical Engineers (ASME):

1. B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, 125 lb.

2. B16.5: Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard

D. American Bearing Manufacturers Association (ABMA):

1. 9: Load Ratings and Fatigue Life for Ball Bearings.

2. 11: Load Ratings and Fatigue Life for Roller Bearings.

E. Hydraulic Institute (HI):

1. Current Standards.

F. NSF International (NSF):

1. 61: Drinking Water System Components - Health Effects

G. National Electrical Manufacturers Association (NEMA):

1. MG1: Motors and Generators.

1.03 SUBMITTALS:

A. Submit the following shop drawings in accordance with Section 01 33 00:

1. Data regarding pump and motor characteristics and performance:

a. Prior to fabrication and testing, provide guaranteed performance curves based on actual shop tests of mechanically duplicate pumps, showing they meet indicated and specified requirements for head, capacity, horsepower, efficiency and NPSH3.

(1) For units of same size and type, provide curves for a single unit only.

b. Provide catalog performance curves at maximum pump speed indicated and specified for each service showing maximum and minimum impeller diameters available, acceptable operating range (AOR) and preferred operating range (POR).

c. Results of shop performance tests as specified.

d. Submit curves for guaranteed performance, and shop performance tests on 8-1/2-inch by 11-inch (A4) sheets, one curve per sheet.

e. Listing and value of all internal friction losses for the entire pump assembly.

f. Shaft power loss

g. Thrust bearing power loss

2. Characteristic curves for variable speed pumps for maximum pump speed and for speeds required to obtain minimum pump flow and head conditions specified and indicated. Identify curves by speed and provide all curves on one sheet. Provide NPSH3 curve for each speed.

3. Shop drawing data for accessory items.

4. Certified setting plans, with tolerances, for anchor bolts.

5. Manufacturer's literature as needed to supplement certified data.

6. Operating and maintenance instructions and parts lists.

7. Listing of reference installations as specified with contact names and telephone numbers.

8. Certified results of hydrostatic testing.

9. Certified results of dynamic balancing.

10. Bearing temperature operating range for the service conditions specified.

11. List of recommended spare parts other than those specified.

12. Shop and field inspection reports.

13. Bearing Life: Certified by the pump manufacturer. Include design data.

14. Pump shop test results.

15. Motor shop test results.

16. Qualifications of field service engineer.

17. Recommendations for short and long-term storage.

18. Resonant frequency analysis.

19. Shop and field testing procedures, pump and piping set up, equipment to be used and ANSI/HI testing tolerances to be followed.

20. Special tools.

21. Number of service person-days provided and per diem field service rate.

22. Vendor shall provide vibration testing procedure for review.

    a. Contractor to complete vibration testing, per procedure, and submit results of field vibration test data including a vibration signature for each pump and drive assembly.

23. Recommended location of discharge pressure gauges.

24. Manufacturer's product data, specifications and color charts for shop painting.

25. Provide a listing of the materials recommended for each service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and indicated.

26. The latest ISO 9001 series certification.

27. Provide a scaled drawing for each pump service showing the pumps, motors, hoists and bridge cranes including equipment weights, lifting attachments, slings and clearances for equipment removal and maintenance. Provide confirmation that pump can be installed and removed for future servicing given the building dimensions and constriants. Confirm pump hoist is adequate for pump removal.

28. Material Certification:

    a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and designed for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

    b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated.

B. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are relative to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no

changes are required, mark all drawings with "No changes required" or provide a statement that no changes are required.

1. Failure to include all drawings or a statement that the equipment specified in this section will result in submittal return without review until a complete package is submitted.

C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.

1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 SPARE PARTS:

A. Comply with the requirements specified in Section 01 61 00.

B. Provide spare parts that are identical to and interchangeable with similar parts installed.

1. For each pump:

a. One complete set of gaskets.

~~b. One mechanical seal repair kit for each pump provided with mechanical seals.~~

c. One set of wearing rings.

2. For each set of pumps of the same size and performance.

a. One set of all special tools required.

1.05 QUALITY ASSURANCE:

A. Comply with the requirements specified in Section 01 43 00.

B. Pumps shall be the product of one manufacturer.

C. Pumps shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

D. Welding: In accordance with latest American Welding Society Code or equivalent.

E. Shop tests as specified.

F. The Contractor shall obtain the pumps, motors, discharge columns, discharge heads, suction cans and appurtenances from the pump manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.

1. Variable frequency motor controllers shall be supplied under Division 26. The pumping system must be a complete and integrated package to insure proper coordination and compatibility and operation of the system.

a. The Contractor shall coordinate the variable frequency motor controllers with the pump and motor manufacturer and submit as part of the shop drawings a written statement signed by the Contractor, pump manufacturer, motor manufacturer and variable frequency motor controller manufacturer that the variable frequency motor controller manufacturer has received the required information from the pump and motor manufacturers and that all parties have reviewed the system and coordinated the equipment selection. Also include all motor data and information that has been used for the coordination.

b. Provide electric motors in accordance with Section 40 05 93.

c. Variable frequency motor controllers shall be supplied under Division 26 in accordance with Section 26 29 23.

G. Services of Manufacturer's Representative as stated in Section 01 43 00 and as specified herein.

H. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:

1. Service Technician must have a minimum of five (5) years of experience, all within the last seven (7) years, on the type and size of equipment.

2. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.

3. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of piping, electrical and miscellaneous utility connection:

a. [2] person-days.

4. Functional Testing: Calibrate, check alignment and perform a functional test with water. Tests to include all items specified.

   a. [2] person-days.

5. Field Performance Testing: Field performance test equipment specified.

   a. [2] person-days.

6. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.

   a. [1] person-days.

7. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.

8. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.

I. Manufacturer of pumps shall have a minimum of five (5) operating installations with pumps of the size specified and in the same service as specified operating for not less than five (5) years.

J. If equipment proposed is heavier or taller, than specified and indicated; provide all structural, architectural, mechanical, electrical and plumbing revisions at no additional cost to the Owner.

1. If equipment is heavier than specified, the Contractor shall provide all hoisting equipment sized to maintain the minimum safety factor between the specified maximum equipment weight and the lifting capacity of the hoisting equipment indicated and specified.

K. For variable speed pump systems the pump manufacturer must perform an analysis of the combined motor and pump assembly for resonant frequency or their harmonics independent of a structure.

1. Submit a copy of these calculations for the record.

2. Should calculations indicate the probability of encountering such frequencies within the speed range required, provide all additional supporting devices necessary to affect the unit mass, and raise or lower resonant point within the speed range required.

3. Provide and install such additional devices at no additional cost to the Owner.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Comply with the requirements specified in Section 01 66 10.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

A. Pump capacities and operating data are indicated in this specification and the Contract Drawings. Pumps shall be able to meet all of the service conditions at the minimum efficiencies stated in this specification.

B. Intermediate Clear Well Pumps: Pump water from the Intermediate Clear Well through the pressure filters, potential future unit processes, and into the finished water storage tank.

C. Conditions of Service:

1. Design conditions:

a. 2 MGD at:

(1) 50.4 ft. Total Dynamic Head (TDH); 81.3 % min. efficiency;

(2) 80.3 ft. TDH; 81.8 % min. efficiency; and 34.4 BHP.

2. Overall Length [bottom of discharge head to bottom of strainer]: 74 inches.

D. Design Heads:

1. The head requirements indicated are the heads required at the pump’s discharge head flange.

2. For wet pit pumps, the pump manufacturer must include all internal losses from the intake bell to the discharge head flange.

E. Coordinate pump dimensions and weights with hoists and bridge cranes as specified in the Contract Documents and as indicated.

2.02 MANUFACTURERS:

A. Vertical Turbine Pumps:

1. National Pump Company

2. Patterson Pump Company

3. Or approved equal.

2.03 SEISMIC DESIGN REQUIREMENTS:

A. Conform to the requirements indicated on the structural drawings and as specified.

B. The Contractor shall conform to the seismic design requirements for this project and for the work of this specification section.

C. Provide all equipment bases, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.

D. Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.04 PUMP CONSTRUCTION:

A. Rotation: Counterclockwise, viewed from the drive end.

B. Design and proportion all parts of pump for the service specified and indicated.

C. Pumping assemblies, including pump, and motor, to operate within vibration and bearing temperature limits specified over the full operable range of the pump performance.

D. Provide no more than the number of stages as indicated to meet the performance specified and indicated.

E. Provide room for inspection, repair and adjustment.

F. Equip pumping assemblies with all specified and required accessories, including lifting attachments and pressure gauges.

G. Apply a never seize compound to all bolts.

H. Discharge Head:

1. Shall be ASTM A53 GR B/ A36 STL fabricated steel, accurately machined with a rabbet fit for mounting the driver and supporting the pump column assembly and with above ground discharge flange machined and drilled to ANSI standards for 150# rating and 10 inches inside diameter. The design shall allow for the head shaft to couple above the mechanical seal or stuffing box.

2. The standard stuffing box shall be cast iron and rated for 150# discharge pressure and shall contain a minimum of five acrylic graphite packing rings and shall have a grease chamber. The packing gland shall be bronze secured in place with stainless steel studs and adjusting nuts. The stuffing box bearing shall be C89835 bismuth bronze. A rubber slinger shall be installed on the top shaft above the

packing gland. The top shaft shall be 416 S.S. and shall extend through the stuffing box.

~~3. If a mechanical seal is used, then a four piece spacer type coupling shall be used to allow seal replacement without motor removal. This will require a motor stand to be used with a cast iron discharge head or an extra height fabricated steel discharge head.~~

4. Impeller adjustment shall be provided at the top of the head shaft by means of an adjusting nut which shall be locked in place.

I. Column Pipe

1. Shall be ASTM A 53/A36 grade B steel pipe. Size shall be such that the friction loss will not exceed 5 ft. per 100 ft., based on the rated capacity of the pump. The column pipe shall be furnished in interchangeable sections not more than (10) feet in length for 1800 RPM shall be flanged connections.

J. Column Assembly – Product Lubricated: Lineshafts

1. Lineshafts shall be 416 stainless steel, turned, ground and polished. They shall be furnished in interchangeable sections not over (10) feet in length for 1800 RPM and (5) feet for 3600 RPM to properly match the discharge column. The shaft shall be sized in accordance with the maximum recommended horsepower for a given size of shaft, taking into account the effect of the hydraulic thrust on the pumping equipment and the weight of the shaft and suspended rotating parts. To ensure accurate alignment of the shafts, they shall be straight within 0.005 in. total indicator reading for a 10 ft. section. The butting faces shall be machined with center relief and square to the axis of the shaft. The line shaft shall be coupled with 304 S.S. stainless steel couplings, and shall be held in place by bronze bearing retainers with neoprene bearings at each flanged or threaded joint.

K. Bowl Assembly:

1. Pump Bowls - shall be of close grained, cast iron ASTM A48 Class 30. Shall be free of blowholes, sand holes, or other detrimental faults and shall be accurately machined and fitted to close tolerances. The bowls shall have vitreous enamel lined waterways to reduce friction losses and provide a maximum efficiency and wear protection. The intermediate bowls shall be provided with bismuth bonze C89835 bearings.

2. Impellers - shall be of cast silicon bronze grade ASTM B584-C876 and shall be enclosed type accurately machined, with 316 stainless steel impeller lock collets. Impellers shall be dynamically balanced to ISO 1940 G63 or better.

3. Suction Bell - shall be grease packed bismuth bronze C89835 bearing and protected by a bismuth bronze C89835 sand collar. Suction bell shall have a

diameter of 14.13". Suction shall be fitted with a stainless steel flow conditioning basket strainer per the following:

a. Provide a vaned flow conditioning basket strainer.

b. Basket strainer shall be approved by a nationally recognized Hydraulics Testing Laboratory.

c. Provide a certified drawing for all baskets for review with pump submittal.

d. Basket minimum design criteria:

(1) Minimum basket clearance from intake floor: 4 inches [100 mm]

(2) Minimum basket height: Equal to intake bell outside diameter (D) divided by three (D/3).

(3) Vane spacing:

(a) Varies based on diameter

(b) Not to exceed 15 degrees.

(4) Bottom grating depth to spacing aspect ratio: 1:1 and minimum of 75% open area

(5) Headloss Coefficient K: 0.70

(6) Material: Type 316L stainless steel

e. Pump manufacturer to coordinate the method of securing the basket to the pump intake bell

f. Manufacturer: Flow Optimizers, LLC. or equal.

4. Bowl Shaft - shall be ASTM A276 grade 416 stainless steel, turned, ground and polished.

2.05 MOTORS:

A. The motor shall be squirrel cage induction design, NEMA design B, 1200 RPM vertical hollow shaft motor*, 40 horsepower (hp), with a non-reverse ratchet. Thrust bearing shall be chosen to handle the entire hydraulic thrust load of the pump plus the weight of the rotating parts. With an AFBMA B-10 one year minimum or five year average life under design conditions. The motor shall be premium efficiency inverter duty per NEMA MG1 Part 31 with a TEFC enclosure, 1.15 service factor, for use on 460 volt, three phase, 60 cycle electric service. The motor rating shall be such that at design it will not be loaded beyond nameplate rating and at no place on the pump curve shall the loading exceed the service factor.

B. See Contract Drawings and specification Section 40 05 93 for additional motor requirements.

2.06 DRAIN, VENT ~~AND SEAL WATER PIPING~~:

A. Provide drains from stuffing box, air/vacuum valves and gauge assemblies and drain piping and valves to discharge into gutters or sumps as indicated and as directed by the Engineer.

B. ~~Provide seal water piping, valves and accessories at pump as specified and indicated.~~

C. Drain and vent piping: Schedule 10S Type 316L stainless steel with VicPress connections or Schedule 40 Type 316L stainless steel with socket welded connections. Provide a sufficient number of unions to permit removal of each valve and in-line device.

~~D. Seal water piping: Schedule 10S Type 316L stainless steel with VicPress connections or Schedule 40 Type 316L stainless steel with socket welded connections. Provide a sufficient number of unions to permit removal of each valve and in-line device.~~

E. Provide pipe and fittings in accordance with Section 40 23 00 and as indicated.

F. Valves: Provide size and type as indicated and in accordance with Section 40 23 00.

2.07 GAUGES:

A. Provide gauges assemblies for discharge of each pump in accordance with Section 40 23 00 and as indicated.

B. Discharge gauges: Provide standard range with top limit above pump shutoff head at maximum pump speed.

1. Scale psi (kPa).

2.08 AIR/VACUUM VALVES:

A. Provide size, type and arrangement as indicated and in accordance with Section 40 23 00.

2.09 SHOP PAINTING:

A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces and interior of column and discharge head, NSF 61 high solids epoxy in accordance with Section 09 91 00.

B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

C. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

2.10 SHOP TESTING:

A. Comply with the requirements specified in Sections 01 43 00, 01 61 00, 43 00 00, and as specified herein.

B. Provide motor shop testing in accordance with Section 40 05 93.

C. Provide testing of variable frequency motor controllers in accordance with Section 26 29 23.

D. Pump Tests:

1. Test pump bowls, column and discharge head under a hydrostatic head of at least 75 psi (500 kPa) or 150 percent of rated shutoff head, whichever is greater. Test pump assembled.

2. Provide certified performance tests as specified herein for all pumps ~~except those specified to be witness tested~~.

3. Certified performance testing.

a. Run pump at full speed rating point for 60 minutes prior to start of any testing.

b. Full speed tests:

(1) Test pumps at the conditions specified and indicated and take not less than seven operating points between shut-off and run out. Test points must be at the conditions specified and indicated.

(2) Take readings to determine flow, differential pressure, rpm, horsepower, and efficiency.

(3) Operate each pump for not less than one hour and take readings to determine that the pump will operate as specified and indicated without cavitation at the specified minimum head condition with not more than the specified NPSH available. Test with the job submergence as indicated.

c. Variable speed tests:

(1) Conduct tests as specified above for full speed at reduced speeds except that tests for cavitation at run out are not required.

(2) Run one speed test at speed required to discharge the minimum rating point specified and indicated with one point of test at the minimum rating point.

(3) Run a second test at a speed approximately midway between full and minimum speed.

(4) Run addition tests for each reduced speed operating condition specified and indicated. See "Conditions of Service" in this specification for operating conditions.

d. Factory tests on pumps:

(1) String test complete assembly with job motor, discharge head, bowl assembly, column and shop variable frequency motor controller.

(a) Use one (1) job motor that is shipped to the pump testing facility for use in these pump tests.

(b) Use a shop variable frequency motor controller in these pump tests.

(c) Test pumps assembled with a nomimal minimum 10 feet (3000 mm) of column or as many sections as is practical for the manufacturer's test pit.

(d) Provide performance curves adjusted for any column length that is not included in the factory string testing.

e. Provide a minimum of 30 days written notice to the Engineer prior to shop testing.

4. Run all tests in accordance with the latest standards of the Hydraulic Institute and as specified.

5. Testing Acceptance Grade and Tolerances:

a. ANSI/HI 14.6 Acceptance Grade: 1U.

b. Efficiency Tolerance: -0 percent.

c. If pumps do not meet the tolerances specified, trim the impeller and retest until the specified results are obtained.

6. ~~In the event that specified tests indicate that pump, motor, or variable frequency drive will not meet specifications, Engineer has the right to require complete witnessed tests for all pumps, motors, and variable frequency drives at no additional cost to the Owner~~.

7. Repeat tests until specified results are obtained.

8. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

~~9. When pump witness performance testing is specified, provide roundtrip airfare, miscellaneous travel costs, and lodging for witness testing for two (2) people.~~

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install items in accordance with shop drawings, manufacturer's printed instructions and as indicated.

B. Install pumping units on a concrete pad and align thereon.

1. Set base on metal shims placed directly under the part of the base carrying the greatest weight and spaced close enough to provide uniform support.

C. After alignment is correct, grout using high grade non-shrink grout.

1. Do not imbed leveling nuts in grout.

3.02 FIELD TESTING:

A. Comply with the requirements specified in Sections 01 43 00, 01 61 00, 26 29 23, 40 05 93, 43 00 00, and as specified herein.

B. Test piping connections to prove the pump nozzle are installed with the pipe in a free supported state and without need to apply vertical or horizontal pressure to align piping with pump nozzles. This must be performed and the piping acceptable prior to any field performance testing.

C. Field testing will not be conducted without an accepted procedure, calibration certificates for all testing equipment, gauges and flow meters and a completed and signed pretesting check list.

D. After installation of pumping equipment, and after inspection, operation, testing and adjustment have been completed by the manufacturer’s field service technician, conduct running test for each pump in presence of the Engineer to determine its ability to operate within the vibration and temperature limits specified, and to deliver its rated capacity under specified conditions.

1. During tests, observe and record head, capacity, pump bearing housings and motor bearing temperature, noise and vibration and motor inputs.

a. Provide vibration signature test data for each pump and drive assembly.

(1) Limit: 50 percent of ANSI/HI allowable limits.

b. Bearing Temperature: Bearing temperature not to exceed 180 degrees F (82 degrees C).

c. Test Duration: Determined by the Engineer, but not less than three hours of continuous operation at each condition specified and indicated.

2. Run each pump for minimum four hours prior to taking temperature readings of the pumps, motors, and shafting.

3. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

4. Repeat tests until specified results are obtained.

5. Contractor to provide all ~~water~~ labor, piping, equipment, flow meters and test gauges for conducting tests.

a. Contractor shall provide calibrated test gauges for all permanently installed gauges and portable calibrated flow meters for all pumping systems even in those cases where permanent flow meters are installed.

b. All calibrations must be within 30 days of the field testing.

c. The testing will not be started and will not be accepted until the calibrated testing equipment stated above is operational and all certifications have been submitted.

d. ~~Contractor is responsible for delivery and disposal of water used for testing~~.

E. Make all adjustments necessary to place equipment in specified working order at time of above tests.

F. Test pump on product only. If product is not available, test with water. ~~Water for testing furnished by Contractor~~.

G. Remove all replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted.

3.03 FIELD TOUCH-UP PAINTING

A. After installation and testing, apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 CONTRACT CLOSEOUT:

A. Provide in accordance with Section 01 77 00.

END OF SECTION

APPENDIX B

DOCUMENTS FURNISHED BY HYDRO QUIP

(FOR INFORMATION ONLY)

NEEP ShallowTray®
Low Profile Air Strippers

- Discreet size designed for smaller spaces, indoors or outdoors
- Removes a wide variety of volatile organic contaminants
- Wide variety of sizes and number of trays used
- Cleaning ports allow easy in-place maintenance, using washing wand and pressure washer
- No removable trays, avoiding air leaks and decreases maintenance time, handling and consumable parts
- Guaranteed performance under specified conditions
- Over 10,000 analytical tests have been performed to confirm favorable results

The NEEP ShallowTray, invented in 1988, was the first low profile air stripper on the market. Since then, over 4,000 units have been installed worldwide. The ShallowTray modeler software program accurately sizes the unit for your application. With this program, equipment performance is guaranteed under specified conditions.

INLET CHAMBER

Influent wastewater enters into the unit through the inlet or optional spray nozzle. The wastewater will then flow over the weir and enter into the aeration trays.

INLET CONNECTIONS

All connections 3" and smaller are FNPT couplings. All connections 4" and larger are flanges with ANSI 150 pound standard bolt circle. Flanged piping connections conform to ANSI B16.5.

AERATION TRAYS

Units are constructed out of polyethylene or stainless steel.

Once the wastewater starts to flow over the trays, clean air is blown up through 3/16” orifices that are strategically spaced in the tray. This injection of clean air will create a froth of bubbles, which generates a large mass transfer surface area. This surface area will volatilize the specified contaminants in the water.

More trays and larger sized units are used to strip the contaminants that require more

residence time to reach optimal volatilization.

The water will flow through a series of aeration tray channels and then flow down through the downcomer to the next tray or water holding sump tank.

OUTLET

Clean water exits the water holding sump tank through the outlet, either by pumped flow or gravity flow discharge.

FEATURES

All units include the following:

- Sump tank
- Cover
- Trays
- Air blower sized to number of trays
- Blower inlet screen and damper
- Mist eliminator
- Water inlet or optional spray nozzle
- Water level sight tube
- Gaskets
- Latches
- Internal piping
- Schedule 80 PVC
- Tray cleanout ports (for stainless steel models only)

For a full list of options, such as gauges, control panels, and alarm switches, see: hydroquipinc.com/air-strippers

NEEP SHALLOWTRAY® CYLINDRICAL (POLYETHYLENE) UNIT

SPECIFICATIONS

* Dimensions are approximate and do not include Skid. Actual dimensions will vary depending on options or blower selection.

** Induced draft configuration

Model	No. of Trays	Flow Rate (GPM)	Dimensions* Ht.	Dimensions* Dia.	Sump Pump Range (GAL)	Sump Cap. (GAL)	Flood Vol. (GAL)	Airflow SCFM (MIN/MAX)	Delta P (IN-H_2O)	Air Duct Dia. Sump Inlet	Air Duct Dia. Outlet Cplg.	Liquid Connection Inlet	Liquid Connection Outlet Pumped	Liquid Connection Outlet Gravity
1300-P SERIES														
NS-1311-P	1	0.5–15	3'11"	28"	15	28	49	150/195	6	8"	8" x 6"	1" FNPT	2" FNPT	2" FNPT
NS-1321-P	2	0.5–15	4'8"	28"	15	28	49	150/195	10	8"	8" x 6"	1" FNPT	2" FNPT	2" FNPT
NS-1331-P	3	0.5–15	5'9"	28"	15	28	49	150/195	14	8"	8" x 6"	1" FNPT	2" FNPT	2" FNPT
NS-1341-P	4	0.5–15	6'10"	28"	15	28	49	150/195	18	8"	8" x 6"	1" FNPT	2" FNPT	2" FNPT
2300-P SERIES														
NS-2311-P	1	1–50	4'6"	44"	34	65	114	300/390	6–10	8"	8" x 6"	1.25" FNPT	3" FNPT	3" FNPT
NS-2321-P	2	1–50	5'3"	44"	34	65	114	300/390	10–14	8"	8" x 6"	1.25" FNPT	3" FNPT	3" FNPT
NS-2331-P	3	1–50	6'0"	44"	34	65	114	300/390	14–18	8"	8" x 6"	1.25" FNPT	3" FNPT	3" FNPT
NS-2341-P	4	1–50	6'9"	44"	34	65	114	300/390	18–22	8"	8" x 6"	1.25" FNPT	3" FNPT	3" FNPT
NS-2351-P**	5	1–50	7'6"	44"	34	65	114	300/390	22–26	8"	8" x 6"	1.25" FNPT	3" FNPT	3" FNPT

NEEP SHALLOWTRAY® RECTANGULAR UNIT

SPECIFICATIONS

* Dimensions are approximate and do not include Skid. Actual dimensions will vary depending on options or blower selection.

** Induced draft configuration

Model	No. of Trays	Flow Rate (GPM)	Dimensions* H	L	W	Sump Pump Range (GAL)	Sump Cap. (GAL)	Flood Vol. (GAL)	Airflow SCFM (MIN/MAX)	Delta P (IN-H_2O)	Air Duct Dia. Sump Inlet	Outlet Cplg.	Liquid Connection Inlet	Outlet Pumped	Outlet Gravity
1300 SERIES															
NS-1311	1	0.5–22.5	4'6"	3'0"	1'0"	10	20	42	150/195	6–10	8"	6"	1.25" FNPT	2" FNPT	2" FNPT
NS-1321	2	0.5–22.5	5'3"	3'0"	1'0"	10	20	42	150/195	10–14	8"	6"	1.25" FNPT	2" FNPT	2" FNPT
NS-1331	3	0.5–22.5	6'0"	3'0"	1'0"	10	20	42	150/195	14–18	8"	6"	1.25" FNPT	2" FNPT	2" FNPT
NS-1341	4	0.5–22.5	6'9"	3'0"	1'0"	10	20	42	150/195	18–22	8"	6"	1.25" FNPT	2" FNPT	2" FNPT
NS-1351	5	0.5–22.5	7'6"	3'0"	1'0"	10	20	42	150/195	22–26	8"	6"	1.25" FNPT	2" FNPT	2" FNPT
NS-1361**	6	0.5–22.5	8'3"	3'0"	1'0"	10	20	42	150/195	26–30	8"	6"	1.25" FNPT	2" FNPT	2" FNPT
2300 SERIES															
NS-2311	1	1–45	4'6"	3'0"	2'0"	21	40	85	300/390	6–10	8"	6"	2" FNPT	3" FNPT	3" FNPT
NS-2321	2	1–45	5'3"	3'0"	2'0"	21	40	85	300/390	10–14	8"	6"	2" FNPT	3" FNPT	3" FNPT
NS-2331	3	1–45	6'0"	3'0"	2'0"	21	40	85	300/390	14–18	8"	6"	2" FNPT	3" FNPT	3" FNPT
NS-2341	4	1–45	6'9"	3'0"	2'0"	21	40	85	300/390	18–22	8"	6"	2" FNPT	3" FNPT	3" FNPT
NS-2351	5	1–45	7'6"	3'0"	2'0"	21	40	85	300/390	22–26	8"	6"	2" FNPT	3" FNPT	3" FNPT
NS-2361**	6	1–45	8'3"	3'0"	2'0"	21	40	85	300/390	26–30	8"	6"	2" FNPT	3" FNPT	3" FNPT

* Dimensions are approximate and do not include Skid. Actual dimensions will vary depending on options or blower selection.

** Induced draft configuration

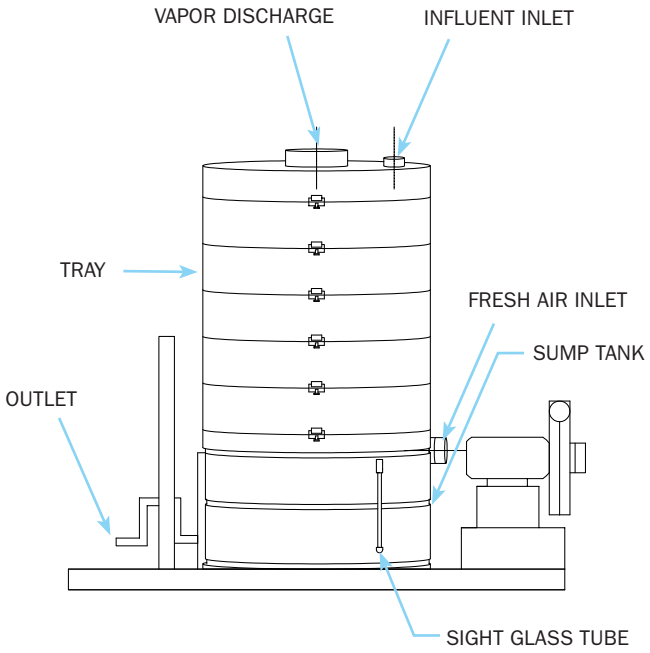
Model	No. of Trays	Flow Rate (GPM)	Dimensions* H	L	W	Sump Pump Range (GAL)	Sump Cap. (GAL)	Flood Vol. (GAL)	Airflow SCFM (MIN/MAX)	Delta P (IN-H_2O)	Air Duct Dia. Sump Inlet	Outlet Cplg.	Liquid Connection Inlet	Outlet Pumped	Outlet Gravity
2600 SERIES															
NS-2611	1	2–115	4'6"	6'0"	2'0"	42	80	170	600/780	6–10	8"	8"	2" FNPT	4" FNPT	4" FLG
NS-2621	2	2–115	5'3"	6'0"	2'0"	42	80	170	600/780	10–14	8"	8"	2" FNPT	4" FNPT	4" FLG
NS-2631	3	2–115	6'0"	6'0"	2'0"	42	80	170	600/780	14–18	8"	8"	2" FNPT	4" FNPT	4" FLG
NS-2641	4	2–115	6'9"	6'0"	2'0"	42	80	170	600/780	18–22	8"	8"	2" FNPT	4" FNPT	4" FLG
NS-2651	5	2–115	7'6"	6'0"	2'0"	42	80	170	600/780	22–26	8"	8"	2" FNPT	4" FNPT	4" FLG
NS-2661**	6	2–115	8'3"	6'0"	2'0"	42	80	170	600/780	26–30	8"	8"	2" FNPT	4" FNPT	4" FLG
3600 SERIES															
NS-3611	1	3–160	4'6"	6'0"	3'0"	64	121	255	900/1170	6–10	8"	10"	3" FNPT	4" FNPT	6" FLG
NS-3621	2	3–160	5'3"	6'0"	3'0"	64	121	255	900/1170	10–14	8"	10"	3" FNPT	4" FNPT	6" FLG
NS-3631	3	3–160	6'0"	6'0"	3'0"	64	121	255	900/1170	14–18	8"	10"	3" FNPT	4" FNPT	6" FLG
NS-3641	4	3–160	6'9"	6'0"	3'0"	64	121	255	900/1170	18–22	8"	10"	3" FNPT	4" FNPT	6" FLG
NS-3651	5	3–160	7'6"	6'0"	3'0"	64	121	255	900/1170	22–26	8"	10"	3" FNPT	4" FNPT	6" FLG
NS-3661**	6	3–160	8'3"	6'0"	3'0"	64	121	255	900/1170	26–30	8"	10"	3" FNPT	4" FNPT	6" FLG
31200 SERIES															
NS-31211	1	6–425	5'7"	11'8"	2'10"	116	301	587	1800/2340	6–10	10"	16"	4" FLG	4" FNPT	8" FLG
NS-31221	2	6–425	6'7"	11'8"	2'10"	116	301	587	1800/2340	10–14	10"	16"	4" FLG	4" FNPT	8" FLG
NS-31231	3	6–425	7'7"	11'8"	2'10"	116	301	587	1800/2340	14–18	10"	16"	4" FLG	4" FNPT	8" FLG
NS-31241	4	6–425	8'7"	11'8"	2'10"	116	301	587	1800/2340	18–22	10"	16"	4" FLG	4" FNPT	8" FLG
NS-31251	5	6–425	9'7"	11'8"	2'10"	116	301	587	1800/2340	22–26	10"	16"	4" FLG	4" FNPT	8" FLG
NS-31261**	6	6–425	10'7"	11'8"	2'10"	116	301	587	1800/2340	26–30	10"	16"	4" FLG	4" FNPT	8" FLG

* Dimensions are approximate and do not include Skid. Actual dimensions will vary depending on options or blower selection.

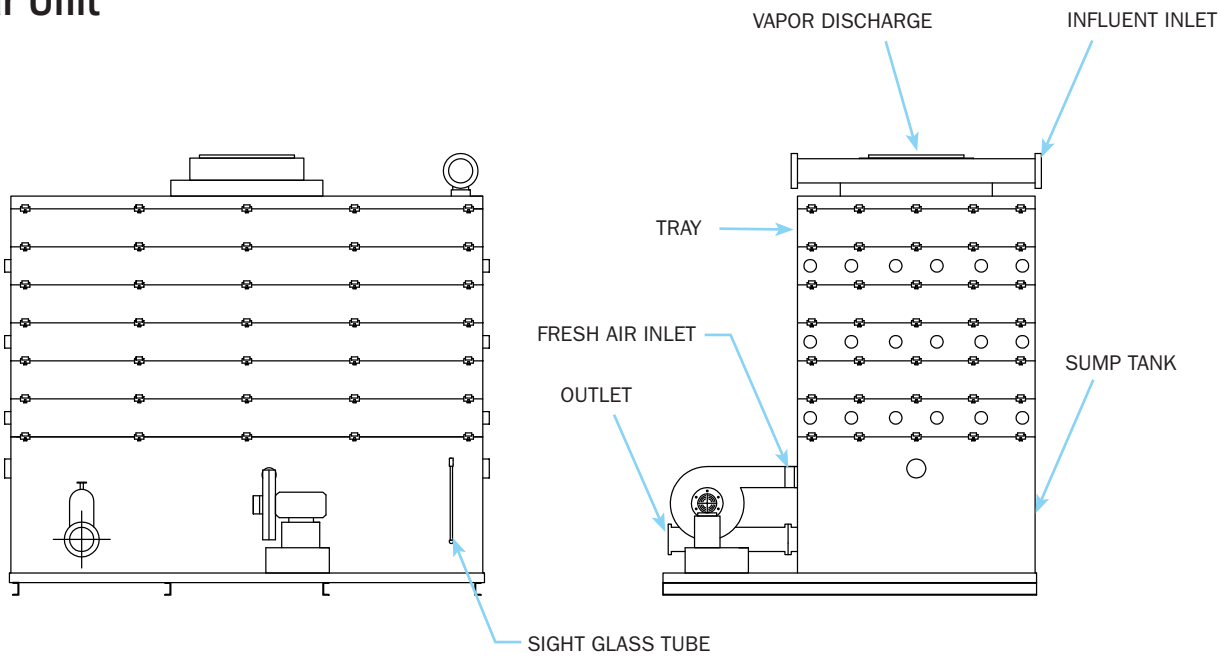
** Induced draft configuration

Model	No. of Trays	Flow Rate (GPM)	Dimensions* H	L	W	Sump Pump Range (GAL)	Sump Cap. (GAL)	Flood Vol. (GAL)	Airflow SCFM (MIN/MAX)	Delta P (IN-H_2O)	Air Duct Dia. Sump Inlet	Outlet Cplg.	Liquid Connection Inlet	Outlet Pumped	Outlet Gravity
41200 SERIES															
NS-41211	1	8–550	5'7"	12'0"	4'0"	171	442	862	2400/3120	6–10	10"	18"	6" FLG	4" FNPT	10" FLG
NS-41221	2	8–550	6'7"	12'0"	4'0"	171	442	862	2400/3120	10–14	10"	18"	6" FLG	4" FNPT	10" FLG
NS-41231	3	8–550	7'7"	12'0"	4'0"	171	442	862	2400/3120	14–18	10"	18"	6" FLG	4" FNPT	10" FLG
NS-41241	4	8–550	8'7"	12'0"	4'0"	171	442	862	2400/3120	18–22	10"	18"	6" FLG	4" FNPT	10" FLG
NS-41251	5	8–550	9'7"	12'0"	4'0"	171	442	862	2400/3120	22–26	10"	18"	6" FLG	4" FNPT	10" FLG
NS-41261**	6	8–550	10'7"	12'0"	4'0"	171	442	862	2400/3120	26–30	10"	18"	6" FLG	4" FNPT	10" FLG
61200 SERIES															
NS-61211	1	12–1000	5'7"	12'0"	6'0"	256	663	1293	3600/4680	6–10	12"	18"	8" FLG	4" FNPT	12" FLG
NS-61221	2	12–1000	6'7"	12'0"	6'0"	256	663	1293	3600/4680	10–14	12"	18"	8" FLG	4" FNPT	12" FLG
NS-61231	3	12–1000	7'7"	12'0"	6'0"	256	663	1293	3600/4680	14–18	12"	18"	8" FLG	4" FNPT	12" FLG
NS-61241	4	12–1000	8'7"	12'0"	6'0"	256	663	1293	3600/4680	18–22	12"	18"	8" FLG	4" FNPT	12" FLG
NS-61251	5	12–1000	9'7"	12'0"	6'0"	256	663	1293	3600/4680	22–26	12"	18"	8" FLG	4" FNPT	12" FLG
NS-61261**	6	12–1000	10'7"	12'0"	6'0"	256	663	1293	3600/4680	26–30	12"	18"	8" FLG	4" FNPT	12" FLG
81200 SERIES															
NS-81211	1	16–1300	5'7"	12'0"	8'0"	342	884	1724	4800/6240	6–10	12"	18"	8" FLG	4" FNPT	12" FLG
NS-81221	2	16–1300	6'7"	12'0"	8'0"	342	884	1724	4800/6240	10–14	12"	18"	8" FLG	4" FNPT	12" FLG
NS-81231	3	16–1300	7'7"	12'0"	8'0"	342	884	1724	4800/6240	14–18	12"	18"	8" FLG	4" FNPT	12" FLG
NS-81241	4	16–1300	8'7"	12'0"	8'0"	342	884	1724	4800/6240	18–22	12"	18"	8" FLG	4" FNPT	12" FLG
NS-81251	5	16–1300	9'7"	12'0"	8'0"	342	884	1724	4800/6240	22–26	12"	18"	8" FLG	4" FNPT	12" FLG
NS-81261**	6	16–1300	10'7"	12'0"	8'0"	342	884	1724	4800/6240	26–30	12"	18"	8" FLG	4" FNPT	12" FLG

Cylindrical (Polyethylene) Unit



Rectangular Unit

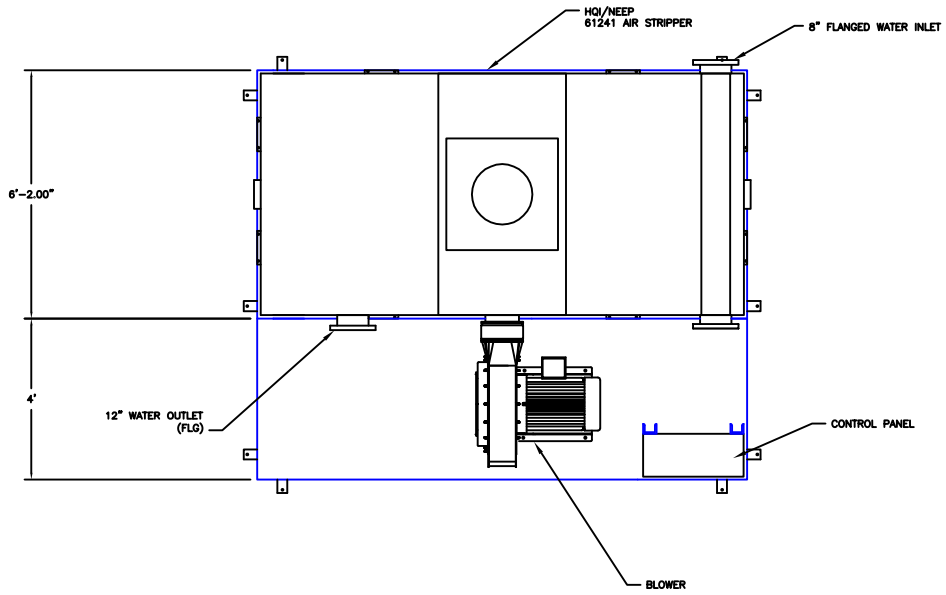


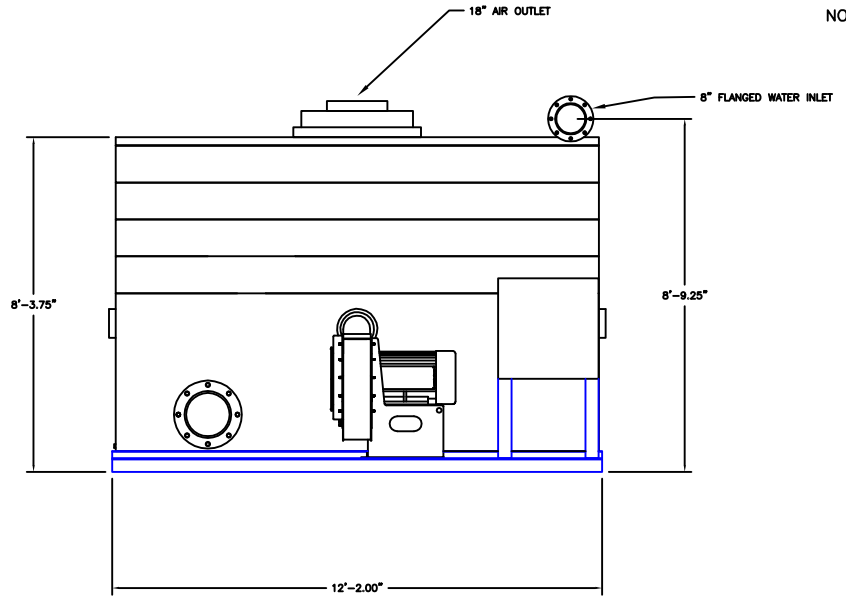
Whether an off-the-shelf unit or customized equipment, we'll help you determine the best solution for your application and site-specific needs.

TEL: 508-399-5771
FAX: 508-399-5352
108 Pond St, Seekonk, MA 02703

hqisales@hydroquipinc.com
www.hydroquipinc.com

REVISIONS			
REV.	DESCRIPTION	DATE	APPR.





NOTES:
- (10) HOLD DOWN TABS SHIPPED LOOSE
- SKIDS SHALL BOLT TOGETHER
- SKIDS SHALL HAVE FORK CHANNELS ON BOTH LONG & SHORT SIDES

HYDRO QUIP
Water Treatment Equipment
Seekonk, Massachusetts 02771

DRWN BY: TRA	DATE: 1/18/18	TITLE: AIR STRIPPER SKID DETAIL				
CHK BY	DATE	AECOM SKIDS			JOB NO.	
APPR BY	DATE	SCALE: 1"=30"	SIZE: C	DWG NO.: 0817T06RAL	SHEET: 1 OF 1	REV

APPENDIX C

SDS FOR HYDRATED LIME

Safety Data Sheet

Hydrated Lime

Revision date:
June 24, 2015

1. Identification

Product Name: Hydrated Lime

Synonyms:
Chemical Hydrate
Commercial Hydrate
Hyd Chem SS,
Hyd Lime Chem,
Hydrate Tailings,
Hydrated Lime Kiln Dust,
Industrial Hydrate,
Pink Hydrate,

Recommended Uses: Water treatment, steel flux, caustic agent, pH adjustment, acid gas absorption, construction

Manufacturer: Carmeuse Lime & Stone

US Office
11 Stanwix Street, 21st Floor
Pittsburgh, PA 15222
Phone: (412) 995-5500
Fax: (412) 995-5594

Canadian Office
PO Box 190
Ingersoll, ON N5C 3K5
Phone: (519) 423-6283
Fax: (519) 423-6545

Emergency Contact: Infotrac: (800) 535-5053 (24 hrs a day, 7 days a week)

2. Hazards Identification

GHS classification

Physical Hazards

None

Health Hazards

Skin Irritation	Category 2
Eye Damage	Category 1
Carcinogenicity	Category 1A
Specific Target Organ Toxicity – Single Exposure	Category 3

GHS Label Elements:

Signal Word: Danger

Hazard Statements:
Causes skin irritation.
Causes serious eye damage.
May cause respiratory irritation.
May cause cancer through inhalation

Precautionary Statements:
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep container tightly closed
Do not breathe dust.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in well-ventilated area
Wear protective gloves, clothing and eye protection

Pictograms:

3. Composition

Chemical name	% by weight	CAS#
Calcium hydroxide	> 85	1305-62-0
Silica-crystalline quartz	< 1	14808-60-7

4. First Aid Measures

Eyes: Immediately flush eyes with generous amounts of water for at least 15 minutes. Pull back the eyelid to ensure that all lime dust has been washed out. Seek medical attention immediately. Do not rub eyes.

Skin: Wash exposed area with large amounts of water. Seek medical attention immediately.

Ingestion: Do not induce vomiting. Seek medical attention immediately. Never give anything by mouth unless instructed to do so by medical personnel.

Inhalation: Move victim to fresh air. Seek medical attention if necessary. If breathing has stopped, give artificial respiration

Most Important Symptoms: Irritation of skin, eyes, gastrointestinal tract or respiratory tract.

Immediate medical attention / special treatment? See first aid information above. Note to Physicians: Provide general supportive measures and treat symptomatically.

5. Fire Fighting Measures

Suitable (and unsuitable) fire extinguishing media: Use dry chemical fire extinguisher. Do not use water or halogenated compounds, except that large amounts of water may be used to deluge small quantities of this product.

Specific hazards arising from the product Inhalation, skin or eye contact, can result in serious injury. This product is not combustible or flammable. This product is not considered to be an

explosion hazard, although reaction with water or other incompatible materials may rupture containers. When this product is wet, it can be very slippery and can result in a slip hazard. Hazardous Combustion Products: None.

Special protective equipment and precautions for fire fighters

Wear full fire-fighting turn-out gear (full Bunker gear), and respiratory protection (SCBA) to prevent inhalation, skin or eye contact.

6. Accidental Release Measures

Personal precautions, protective equipment, emergency procedures:

Avoid inhalation, eye and skin contact. Avoid generating airborne dust. Wear appropriate protective clothing as described in section 8.

Methods and materials for containment and clean up:

Utilize cleanup methods that minimize generating dust: vacuum. Avoid dry sweeping. Residue on surfaces may be removed with copious amount of water or vinegar.

7. Handling & Storage

Safe Handling: Avoid inhalation, skin and eye contact. Avoid generating airborne dust. An eye wash station should be readily available when this product is handled.

Safe Storage: Keep in tightly closed containers. Protect containers from physical damage. Store in a cool, dry, and well-ventilated location. Do not store near incompatible materials (see Section 10 below). Keep away from moisture. Long-term storage in aluminum containers is not recommended, as calcium oxide may corrode aluminum over long periods of time

8. Exposure Controls/Personal Protection

Occupational Exposure Limits

	OSHA PEL (mg/m^3)	ACGIH TLV (mg/m^3)	Ont. Reg. 833 TWAEV (mg/m^3)
Calcium hydroxide	15 (total) 5 (respirable)	5	5
silica - crystalline quartz	30 / (% silica +2) (total) 10 / (% silica +2) (respirable)	0.025 (respirable)	0.1

Engineering Controls: Use with adequate general or local exhaust ventilation and to maintain exposure below occupational exposure limits.

Individual Protection Measures (Personal Protective Equipment):

Specific Eye / Face Protection:	Safety glasses with side shields. In windy conditions, or if work activity generates elevated airborne dust levels, dust proof or chemical goggles are recommended. Contact lenses should not be worn.
Specific Skin Protection:	When there is a risk of skin contact, wear appropriate clothing and gloves to prevent contact.

Specific Respiratory Protection:	If exposure limits are exceeded, an approved particulate respirator, or supplied air respirator, appropriate for the airborne concentrations, should be used. Selection and use of the respiratory protective equipment must be in accordance with applicable regulations and good industrial hygiene practices.
Other:	An emergency eye wash fountain and shower are recommended.

9. Physical & Chemical Properties

Appearance:	White powder
Odor:	Odorless
Odor threshold:	Not Applicable
pH at 25 degrees C:	12.45
Melting Point:	1076 °F (580 °C)
Boiling Point and range:	5162 °F (2850 °C)
Flash Point:	Not Applicable
Evaporation Rate:	Not Applicable
Flammability:	Not Applicable
Upper/lower flammability or explosive limits	Not Applicable
Vapor pressure/density:	Non Volatile
Relative density:	2.24
Solubility:	Slightly soluble in water: 0.2% @ 0 °C. Soluble in acids, glycerin, and sugar solutions
Partition coefficient: n-octanol/water	Not applicable
Auto-ignition temperature:	Not Available
Decomposition temperature:	Not available
Viscosity:	Not Applicable

10. Stability & Reactivity

Reactivity:	Reacts with acids to form calcium salts, releasing heat. Reacts with carbon dioxide in air to form calcium carbonate. See also Incompatibility below.
Chemical stability:	Stable under normal storage and handling conditions.
Possibility of Hazardous Reactions:	See “reactivity” above.
Conditions to avoid:	Vicinity of incompatible materials.

Incompatibility: This product should not be mixed or stored with the following materials, due to the potential for violent reaction and release of heat:

- acids
- reactive fluoridated compounds
- reactive brominated compounds
- reactive powdered metals
- reactive phosphorous compounds
- aluminum powder
- organic acid anhydrides
- nitro-organic compounds
- interhalogenated compounds

Hazardous decomposition products: None

11. Toxicological Information

Likely routes of exposure & symptoms:

Eyes: Contact can cause severe irritation or burning of eyes, including permanent damage.

Skin: Contact can cause severe irritation or burning of skin, especially in the presence of moisture.

Ingestion: This product can cause severe irritation or burning of gastrointestinal tract if swallowed.

Inhalation: This product can cause severe irritation of the respiratory system.

Chronic health effects: This product contains trace amounts of crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica can cause silicosis, as serious lung disease.

Respiratory or skin sensitization: This material is not known to cause sensitization

Germ cell mutagenicity: No data available.

Carcinogenicity: This product is not listed as carcinogenic by OSHA, IARC, NTP, ACGIH, or the EU Directives. This product may contain trace amounts of crystalline silica quartz which is listed by IARC as “Carcinogenic to Humans” (Group 1) and “Known to be a Human Carcinogen" by NTP (National Toxicology Program).

Reproductive toxicity: No Data Available.

Numerical Measures of Toxicity

Crystalline Silica: Oral Rat LD_{50} > 22,500 mg/kg
Calcium Hydroxide: Oral (rat) LD_{50}: 7340 mg/kg

12. Ecological Information

Because of the elevated pH of this product, it might be expected to produce some ecotoxicity upon exposure to certain aquatic organisms and aquatic systems in high concentrations
This material shows no bioaccumulation effect or food chain concentration toxicity.

13. Disposal Considerations

Dispose of contents in accordance with federal, state, provincial and local regulations.

14. Transport Information

Not regulated by Department of Transportation, Transport of Dangerous Goods

15. Regulatory Information

CERCLA Hazardous Substances	Not listed
SARA Toxic Chemical (40 CFR 372.65)	Not listed
SARA Section 302 Extremely Hazardous Substances (40 CFR 355)	Not listed
SARA 311/312	Not listed
SARA Section 313 Toxic Chemicals reporting requirements	None
Threshold planning quantity (TPQ)	Not listed
RCRA Hazardous Waste Classification (40 CFR 261)	Not Classified
EPA Toxic Substances Control Act (TSCA) Status	All of the components of this product are listed on the TSCA
California Proposition 65	Airborne crystalline silica particulates of respirable size are known to the State of California to cause cancer.
NFPA ratings	Health: 3 Fire: 0 Reactivity: 0
HMIS Ratings	Health: 3 Fire: 0 Reactivity: 0 Personal protection: E
OSHA Specifically regulated substance (29 CFR 1910)	Not listed
OSHA Air contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)	Listed
MSHA	Not listed
Canada DSL	Listed
Canadian WHMIS Classification	D2A, Materials Causing other toxic effects. E, Corrosive Material

Canada CPR This product has been classified in accordance with the hazard criteria of the Controlled Products Regulation of a Canada and this SDS contains all the required information.

16. Other Information

List of GHS Hazard Statements:	H315: Causes skin irritation H318: Causes serious eye damage H335: May cause respiratory irritation. H350: May cause cancer through inhalation
List of GHS Precautionary Statements:	P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P233: Keep container tightly closed P260: Do not breathe dust. P264: Wash thoroughly after handling. P270: Do not eat, drink or smoke when using this product. P271: Use only outdoors or in well-ventilated area P280: Wear protective gloves, clothing and eye protection

Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act	IARC	International Agency for Research on Cancer
NTP	National Toxicology Program		

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